

## CLAIMS

- 1           1. Apparatus for cleaning residue from a bore of a tube, comprising:
  - 2           a) a hose having a spray tip containing a plurality of orifices;
  - 3           b) a water source coupled to said hose and capable of delivering water to said hose
  - 4           at a pressure in excess of 1,000 psi; and
  - 5           c) a framework supporting i) transport means for extending and retracting said
  - 6           hose with a reciprocating motion, ii) reel means for collecting and distributing said hose
  - 7           along a longitudinal drive axis common to each of said transport means and reel means
  - 8           and for layering said hose into coils concentric to said drive axis, and iii) means for
  - 9           rotating said transport means, whereby said hose and spray tip are rotated as they extend
  - 10          and retract along a bore of said tube to remove said residue.
- 1           2. Apparatus as set forth in claim 1 including an operator control gun coupled to
- 2           said framework and having a bore through which said hose is directed.
- 1           3. Apparatus as set forth in claim 2 wherein said operator control gun includes a
- 2           plurality of air valves for directing the operation of said transport means and said reel
- 3           means and thereby the rotation and to and fro movement of said hose.
- 1           4. Apparatus as set forth in claim 3 including a first air motor coupled to rotate
- 2           said transport means and including a second air motor coupled to axially direct said hose.
- 1           5. Apparatus as set forth in claim 1 including means for selectively regulating
- 2           axial hose travel to a range of 2 feet per second to 10 feet per minute.
- 1           6. Apparatus as set forth in claim 1 including means for selectively regulating the
- 2           rotation of said transport means to a range of 10 to 400 RPM.
- 1           7. Apparatus as set forth in claim 1 including brake means for controlling the
- 2           rotation of said reel means to prevent hose spillage and hose kinking.

1           8. Apparatus as set forth in claim 7 wherein said brake means comprises a disk  
2 brake and caliper.

1           9. Apparatus as set forth in claim 1 wherein said reel means includes a hub  
2 mounted concentric to said longitudinal drive axis, a plurality of webs mounted to said  
3 hub and each having a channel and wherein said transport means includes a member for  
4 directing said hose to and from the channel of said webs.

1           10. Apparatus as set forth in claim 1 wherein said reel means includes a plurality  
2 of annular bands mounted to said webs.

1           11. Apparatus as set forth in claim 1 wherein said reel means includes a hub  
2 mounted concentric to said longitudinal drive axis, a plurality of webs mounted to said  
3 hub and at least one endless shroud mounted to said webs to define a storage channel and  
4 wherein said transport means includes a member for directing said hose to and from said  
5 channel.

1           12. Apparatus as set forth in claim 1 wherein said transport means includes a  
2 member for directing said hose to and from said reel means and means for layering said  
3 hose at said reel in coils.

1           13. Apparatus as set forth in claim 1 wherein said transport means includes a  
2 tensioner for controlling the contact force of said pinch wheels with said hose.

1           14. Apparatus as set forth in claim 1 wherein said transport means includes a  
2 plurality of pinch wheels mounted to contact said hose and control means for directing  
3 the reciprocating axial movement of said hose in synchrony with the rotational movement  
4 of said hose.

1           15. Apparatus as set forth in claim 14 wherein at least one of said plurality of  
2 pinch wheels is mounted to pivot relative to a stationary pinch wheel between a first

3 condition whereat said pivoting and stationary pinch wheels are released from contact  
4 with said hose and a second condition whereat said pivoting and stationary pinch wheels  
5 grip said hose.

1 16. Apparatus as set forth in claim 15 including a plurality of pivoting pinch  
2 wheels and means for resiliently biasing said plurality of pivoting pinch wheels.

1 17. Apparatus as set forth in claim 14 wherein each of said plurality of pinch  
2 wheels include a circumferential groove located to contain and direct the travel of said  
3 hose.

1 18. Apparatus as set forth in claim 1 wherein said transport means includes a  
2 tensioner for selectively controlling the contact force of an idler pulley with a drive belt  
3 coupled to a drive motor between a non-contact position and a tensioned position.

1 19. Apparatus as set forth in claim 1 wherein said reel means is coupled to  
2 passively follow said transport means.

1 20. Apparatus for cleaning residue from a bore of a tube, comprising:

2 a) a hose having a spray tip containing a plurality of orifices;

3 b) a water source coupled to said hose and capable of delivering water to said hose  
4 at a pressure in excess of 1,000 psi;

5 c) a framework supporting i) transport means including a plurality of pinch  
6 wheels mounted to contact said hose, ii) reel means for collecting and distributing said  
7 hose along a longitudinal drive axis common to each of said transport means and reel  
8 means and for layering said hose into coils concentric to said drive axis, and iii) means  
9 for rotating said transport means; and

10 d) an operator control gun coupled to said framework and having a bore through  
11 which said hose is directed and control means for directing movement of said pinch

12 wheels and a reciprocating axial movement of said hose in synchrony with a rotational  
13 movement of said hose, whereby said hose and spray tip are rotated as they extend and  
14 retract to remove residue from a bore of said tube.

1 21. Apparatus as set forth in claim 20 wherein said transport means includes an  
2 arm for directing said hose onto said reel, wherein said reel means includes a plurality of  
3 planar members mounted to a plurality annular bands, wherein a tapered channel extends  
4 in each planar member at an acute angle relative to the longitudinal drive axis and  
5 wherein said hose is directed by said arm into and from said channel.

1 22. Apparatus as set forth in claim 20 wherein at least one of said plurality of  
2 pinch wheels is mounted to pivot relative to a stationary pinch wheel between a first  
3 condition whereat said pivoting and stationary pinch wheels are released from contact  
4 with said hose and a second condition whereat said pivoting and stationary pinch wheels  
5 grip said hose.

1 23. Apparatus as set forth in claim 20 including a brake for controlling the  
2 rotation of said reel means to prevent hose spillage and hose kinking.

1 24. Apparatus as set forth in claim 20 wherein said transport means includes an  
2 air swivel for coupling control air signals between said operator gun and said framework  
3 to control the rotation of said transport means and axial movement of said hose at said  
4 transport means relative to said reel means.

1 25. Apparatus as set forth in claim 20 wherein said transport means and said reel  
2 means are supported from and secured to bearing surfaces at said framework with  
3 interconnected clamped bearings.

1 26. Apparatus as set forth in claim 20 wherein said reel means is coupled to  
2 passively follow said transport means.

1           27. Apparatus for cleaning residue from a bore of a tube, comprising:  
2           a) a hose having a spray tip containing a plurality of orifices;  
3           b) a water source coupled to said hose and capable of delivering water to said hose  
4           at a pressure in excess of 1,000 psi;  
5           c) a framework supporting i) reel means for collecting and distributing said hose,  
6           ii) transport means having an air swivel and a plurality of pinch wheels mounted to  
7           contact and direct said hose along said longitudinal drive axis and an arm for layering  
8           said hose into coils on said reel means concentric to a longitudinal drive axis, and iii)  
9           means for rotating said transport means; and  
10          d) an operator control gun coupled to said framework and having a bore through  
11          which said hose is directed and control means for directing movement of said pinch  
12          wheels and a reciprocating axial movement of said hose in synchrony with a rotational  
13          movement of said hose, whereby said hose and spray tip are rotated as they extend and  
14          retract to remove residue from a bore of said tube.

1           28. Apparatus as set forth in claim 27 wherein at least one of said plurality of  
2           pinch wheels is mounted to pivot relative to a stationary pinch wheel between a first  
3           condition whereat said pivoting and stationary pinch wheels are released from contact  
4           with said hose and a second condition whereat said pivoting and stationary pinch wheels  
5           grip said hose.

1           29. Apparatus as set forth in claim 27 wherein said transport means includes  
2           means for controlling the contact force of said pinch wheels with said hose.

1           30. Apparatus as set forth in claim 27 wherein said transport means and said reel  
2           means are supported from and secured to bearing surfaces at said framework with  
3           interconnected clamped bearings.

1           31. Apparatus as set forth in claim 27 including a disk brake and caliper for  
2 controlling the rotation of said reel means to prevent hose spillage and hose kinking.

1           32. Apparatus as set forth in claim 27 wherein said reel means includes a hub  
2 mounted concentric to said longitudinal drive axis, a plurality of webs mounted to said  
3 hub and at least one endless shroud mounted to said webs to define a storage channel and  
4 wherein said arm directs said hose to and from said channel.

1           33. Apparatus as set forth in claim 27 wherein said reel means is coupled to  
2 passively follow said transport means.

1           34. Apparatus for cleaning residue from a bore of a tube, comprising:

2           a) a hose having a spray tip containing a plurality of orifices;

3           b) a water source coupled to said hose and capable of delivering water to said hose  
4 at a pressure in excess of 1,000 psi; and

5           c) a framework supporting i) transport means for extending and retracting said  
6 hose with a reciprocating motion, ii) reel means coupled to passively follow for collecting  
7 and distributing said hose along a longitudinal drive axis common to each of said  
8 transport means and reel means and for layering said hose into coils concentric to said  
9 drive axis, and iii) means for rotating said transport means and wherein said reel means is  
10 coupled to passively follow said transport means, whereby said hose and spray tip are  
11 rotated as they extend and retract along a bore of said tube to remove said residue.